

FLUID-SEDIMENT INTERACTIONS IN THE NEARSHORE

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LONG-TERM GOALS

The long range goal of this research is to characterize and understand small scale processes of coastal sediment transport well enough to be able to determine a-priori what level of discretization and averaging is appropriate in modeling efforts intended to identify morphological changes of arbitrary detail.

OBJECTIVES

The immediate objectives of this project are to examine the importance of various time and space scales of sediment transport in the context of morphology change.

APPROACH

Using a grid of collocated stacks of concentration (FOBS) sensors and velocity (VEMA) sensors, we will estimate the vertical distribution of sediment flux at each position in the grid. Using cross-spectral analysis we will determine the frequency distribution of the flux at each elevation. We can then use this information from each location to estimate spatial gradients (divergence) in the total transport as well as determine what the divergence is for separate frequency bands (e.g. mean, infra-gravity, incident). Using the wide range of conditions encountered in 2 months of data collection, we will examine exactly how these results change with changing incident wave conditions, differing bottom morphologies and varying water depths.

WORK COMPLETED

The field experiment/data collection portion of this project is almost complete. In the 1st month of the award, we have completed the 7th week of data collection. Pressure, velocity and concentration measurements have been collected 24 hours/day at 9 locations with 5 in the longshore and 5 in the cross-shore. Vertical distributions of concentration are available at 7 of those stations and vertical distributions of velocity are available at 4-6 of those locations depending on the period during the experiment. The data has been examined for data quality and is fully archived on a database which includes sensor calibration and location information.

RESULTS

Preliminary analysis of the data indicates that significant erosional and depositional events were observed during the experiment. Locations on the inner bar and inner trough were the most dynamic with instrument clusters experiencing multiple cycles of burial and exposure of 30 cm. or more. Patterns of burial or exposure exhibited 2 patterns, either a gradual continuous evolution or a long term ($O(\text{days})$) change during a period of large scale fluctuations (Figure 1) possibly suggesting large scale bed form migration. The vertical scale of sediment distribution appears to vary greatly with more energetic conditions often exhibiting sediment flux concentrated closer to the bed than during weaker conditions.

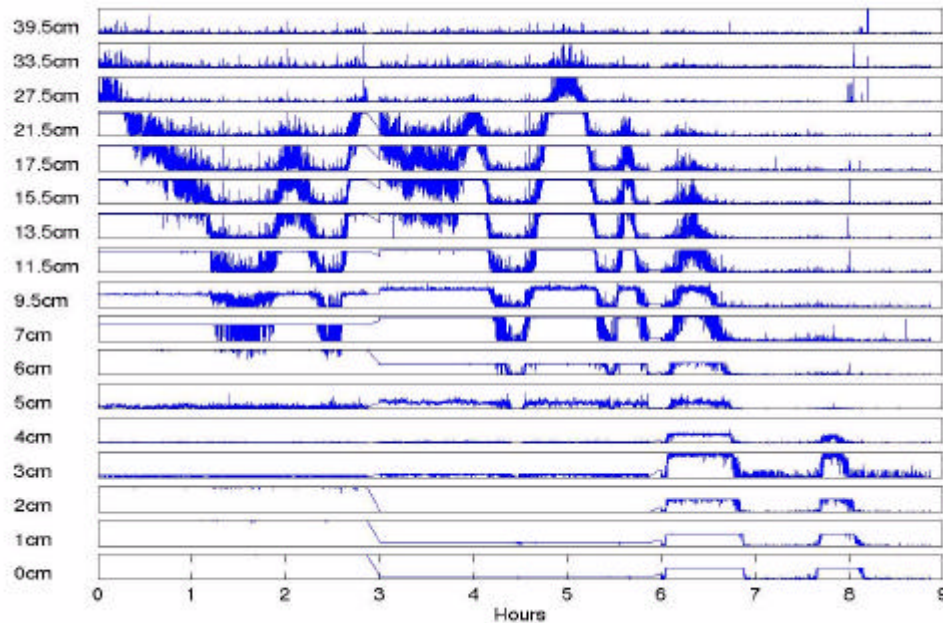


Figure 1: Time series of 17 channels of raw concentration measurements at site B starting at 19:59EDT on 19 Oct. 1997. FOBS is saturated when buried so bed level is near top of quiescent channels. Figure indicates that net 28 cm of erosion in 9 hours is immersed in large scale, $O(20\text{cm})$, and short term, $O(\text{hr.})$ oscillations of the bed. Notice that vertical scale of sediment concentration is typically less than 10 cm. despite mean longshore currents greater than 1m/s.

IMPACT/APPLICATIONS

A large, high quality, data set of sediment concentration and fluid velocity has been collected in a variety of conditions throughout the surf zone. This data set will be very instructive in understanding the small scale sedimentary processes from which large scale

morphologic change derives. This data also provides an excellent database for the testing of process based models of sediment transport.

TRANSITIONS

The data from this project has been collected and is being used in conjunction with Dick Sternberg and Andrea Ogston (U. Wash.) and Reg. Beach (ONR).

RELATED PROJECTS

See above.